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PATENT ABSTRACTS OF JAPAN

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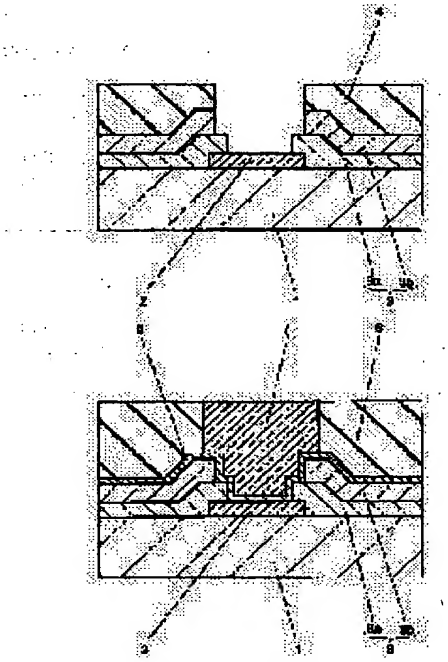
(54) BUMP FORMING METHOD AND MANUFACTURING METHOD OF SEMICONDUCTOR DEVICE HAVING BUMPS

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce the bump height error and prevent poor bonding by plating a thick film paste to from bumps, polishing the bump surface to be flat, and removing the resist.
SOLUTION: A resist 4 is coated on a bump forming face, patterned and etched with the resist 4 used as a mask, a protective insulation film 3 on electric pads 2 forming the bumps is selectively removed to from openings, then the resist is removed, a barrier metal 5 is formed, a thick film resist 6 is coated, Au i.e., bump forming material is deposited the barrier metal 5 in the openings to from bumps 7 which are then polished to be flat, and the resist 6 is removed to expose the metal 5 and bumps 7. Thus, the bump height error is reduced and poor bonding is avoided.



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[Claim(s)]

[Claim 1] The formation method of the bump characterized by having the process which is a bump's formation method and applies a resist to a bump forming face, the process which performs opening for bump formation to the aforementioned resist, the process which forms a bump, the process which grinds the aforementioned bump, and the process which removes the aforementioned resist.

[Claim 2] The formation method of the bump according to claim 1 characterized by performing the aforementioned polish by the CMP method.

[Claim 3] The formation method of the bump according to claim 1 or 2 characterized by removing the aforementioned resist after the aforementioned bump's polish is performed.

[Claim 4] The formation method of a bump given in any of the claim 1 characterized by forming the aforementioned bump with electrolysis plating, or a claim 3 they are.

[Claim 5] The manufacture method of a semiconductor device of having the bump characterized by to have the process which is the manufacture method of a semiconductor device of having the bump who uses as an end-connection child with the exterior of the circuit formed in the semiconductor chip, and applies a resist to a bump forming face, the process which performs opening for bump formation to the aforementioned resist, the process which forms a bump, the process which grind the aforementioned bump, and the process which remove the aforementioned resist.

[Claim 6] The manufacture method of a semiconductor device of having the bump according to claim 5 characterized by performing the aforementioned polish by the CMP method.

[Claim 7] The manufacture method of a semiconductor device of having the bump according to claim 5 or 6 characterized by removing the aforementioned resist after the aforementioned bump's polish is performed.

[Claim 8] The formation method of a bump given in any of the claim 5 characterized by

forming the aforementioned bump with electrolysis plating, or a claim 7 they are.

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] About the manufacture method of a semiconductor device of having a bump's formation method and a bump, especially, this invention is applied to formation of a bump with a high precision, and relates to effective technology.

[0002]

[Description of the Prior Art] In manufacture of a semiconductor device, after forming a circuit on the principal plane of a semiconductor wafer, in case a semiconductor wafer is divided into each semiconductor pellet and it mounts in each semiconductor pellet, a printed circuit board, etc., after connecting the lead which becomes an end-connection child, it holds in a package and a semiconductor device is done.

[0003] There is the method of connecting a bump and a lead collectively (gang bonding) by forming in a semiconductor chip the bump who is the salient electrode which used gold, a pewter, copper, etc., carrying out alignment of this bump and lead, pressing a bonding tool, and pressurizing and heating them for connection with this lead and semiconductor chip.

[0004] There are a mushroom bump of a semi-sphere configuration and a cylindrical shape-like straight wall bump as such a bump. Since, as for a mushroom bump, plating grows up to be also a longitudinal direction in addition to lengthwise, if detailed-ization of a bump pitch progresses, the short-circuit between bumps will become easy to take place. On the other hand, by the straight wall bump, since plating grows up to be lengthwise, there is a process margin, and it may be adapted for the aforementioned detailed-ization. This straight wall bump's manufacture process is explained below.

[0005] First, after removing alternatively the protective coat formed on the electrode pad using a phot lithography technology, preparing opening and removing a resist, barrier metal is formed all over a wafer. Next, a thick-film resist is applied, with a phot lithography technology, opening for bump plating is prepared and a bump is formed by electrolysis plating by using barrier metal as an electrode. Then, a thick-film resist is removed and etching removal of the barrier metal which has exposed the bump as a mask is carried out.

[0006] Such a bump's formation method is indicated by the 73rd page of "a guide to TAB technical" of the Kogyo Chosakai Publishing Co., Ltd. publication, or the 81st page.

[0007]

[Problem(s) to be Solved by the Invention] In such a bump's formation, a certain amount

of error will arise in a bump's height according to causes, such as a slight difference among plating conditions. When there are about 6 micrometers of this error, for example, the difference in a height of about a maximum of 12 micrometers may arise among bumps. In case the aforementioned package connection is made by the difference in such bump height, the welding pressure of the aforementioned bonding tool will change with each bumps, and the poor bonding from which connection of some bumps becomes poor will arise, without heating joining each bump uniformly. If such poor bonding arises, it will become impossible a poor operation or operating a semiconductor device, and the reliability of equipment will fall.

[0008] The influence by the error of such bump height poses a more serious problem as a bump's pitch becomes small.

[0009] The purpose of this invention decreases the error of bump height, and is to offer the technology which can prevent poor bonding.

[0010] The other purposes and the new feature will become clear by description and the accompanying drawing of this specification at the aforementioned row of this invention.

[0011]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.

[0012] A bump is formed by plating using a thick-film resist, and the aforementioned resist is removed after grinding and carrying out flattening of a bump's front face.

[0013] Since the welding pressure of a bonding tool joins each bump uniformly and heating joins each bump uniformly in case according to the means mentioned above the error of bump height decreases and package connection is made by the aforementioned flattening, it is hard coming to generate poor bonding.

[0014] It becomes possible to prevent the poor bonding by the error of bump height by it.

[0015] Hereafter, the composition of this invention is explained with the gestalt of operation.

[0016] In addition, in the complete diagram for explaining the gestalt of operation, what has the same function attaches the same sign, and explanation of the repeat is omitted.

[0017]

[Embodiments of the Invention] What is shown in drawing 1 or drawing 7 is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention for every process.

[0018] The electrode pad of the aluminum prepared in the semiconductor substrate 1 in order that the semiconductor substrate by which one formed the predetermined circuit in the principal plane among drawing, and 2 might connect the circuit and external

terminal which were formed in the semiconductor substrate, 3 is a protection insulator layer which protects a semiconductor pellet, and has composition which carried out the laminating of SiN film 3a by the plasma CVD method for preventing permeation of moisture, and the resin film 3b of the polyimide system which prevents an alpha-rays soft error with the gestalt of this operation.

[0019] First, a resist 4 is applied to a bump forming face, it etches by using as a mask the resist 4 which carried out patterning with a phot lithography technology, the protection insulator layer 3 on the electrode pad 2 which forms a bump is removed alternatively, and opening is prepared. This state is shown in drawing 1 .

[0020] After removing a resist 4, the barrier metal 5 is formed by the spatter all over semiconductor substrate 1. This state is shown in drawing 2 . The multilevel-metal film which carried out the laminating of thin films, such as Cr or Ti with high electrode pad 2 and adhesion, and bump formation material and thin films, such as W, Pt, Ag, Cu, nickel, etc. with high adhesion, as a barrier metal 5 is formed.

[0021] Next, the thick-film resist 6 of 10-50-micrometer ** is applied, and patterning of the opening for bump plating is carried out with a phot lithography technology. This state is shown in drawing 3 .

[0022] By using barrier metal 5 as an electrode, using electrolysis plating, the gold which is bump formation material is made to adhere to the barrier metal 5 in opening, and a bump 7 is formed. This state is shown in drawing 4 .

[0023] Flattening of the bump 7 who formed is ground and carried out by the CMP (Chemical Mechanical Polishing) method. This state is shown in drawing 5 . The CMP method is the method of rotating, pressing the wafer which formed the device in the abrasive cloth which attached the medical fluid, and grinding a front face according to the synergistic effect of a chemical operation of a medical fluid and a physical operation of an abrasive cloth.

[0024] After polish, a resist 6 is removed and the barrier metal 5 and a bump 7 are exposed. This state is shown in drawing 7 . Etching removal of the barrier metal 5 which has exposed the bump 7 who formed as a mask is carried out, and a bump's 7 formation process is completed. This state is shown in drawing 7 .

[0025] In the gestalt of this operation, since it grinds by the CMP method, bump height can be equalized in a high precision. Moreover, since it grinds after the resist at the time of bump formation has adhered, the damage by the medical fluid used for the CMP method can be prevented, and there are few injuries on the bump at the time of polish, and they can also prevent adhesion of the foreign matter to an element forming face.

[0026] Thus, the state where the semiconductor chip in which the bump was formed was

mounted is illustrated to drawing 8 .

[0027] the base material 8 in which the TCP (TapeCarrier Package) type semiconductor device mounted in the TAB (Tape Automated Bonding) tape in this example is shown and which a TAB tape becomes from insulating resin films, such as a polyimide, -- adhesives -- minding -- or -- direct -- conductors, such as copper foil, -- a film -- forming -- this conductor -- a film is processed by etching and lead 9 is formed Alignment of the end of this lead 9 is carried out to the bump 7 of a semiconductor chip 10, it is heated and pressurized, and lead 9 and a bump 7 are connected. An end of bonding performs potting closure which a semiconductor chip 10 sets damp-proof improvement as the main purpose, and the liquefied closure resins 11, such as epoxy, were applied [closure] to a part for the principal plane of a semiconductor chip 10, and the connection of lead 9, and carried out heating solidification of this.

[0028] In addition, with the form of this operation, although the bump was ground using the CMP method, even if it uses other polish methods, this invention can be carried out.

[0029] As mentioned above, although invention made by this invention person was concretely explained based on the form of the aforementioned implementation, this invention of the ability to change variously in the range which is not limited to the form of the aforementioned implementation and does not deviate from the summary is natural.

[0030] For example, although the form of the aforementioned operation explained the case where a bump was formed in a semiconductor chip, it is effective even if it uses this invention for other bump formation, such as a mounting substrate or a TAB tape, for example.

[0031]

[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly.

[0032] (1) According to this invention, it is effective in the ability to lessen the error of bump height.

[0033] (2) According to this invention, it is effective in the faulty connection of a bump and a lead decreasing with the aforementioned effect (1).

[0034] (3) According to this invention, it is effective in the reliability of a semiconductor device improving with the aforementioned effect (2).

[Brief Description of the Drawings]

[Drawing 1] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 2] It is important section drawing of longitudinal section showing the

formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 3] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 4] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 5] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 6] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 7] It is important section drawing of longitudinal section showing the formation method of the bump who is the gestalt of 1 operation of this invention.

[Drawing 8] It is drawing of longitudinal section showing the TCP type semiconductor device mounted in the TAB tape.

[Description of Notations]

1 [-- A protection insulator layer, 3 a--SiN films, 3b / -- The resin film of a polyimide system, 4 / -- A resist, 5 / -- Barrier metal, 6 / -- A resist, 7 / -- A bump, 8 / -- A base material, 9 / -- A lead, 10 / -- A semiconductor chip, 11 / -- Closure resin 11.] -- A semiconductor substrate, 2 -- An electrode pad, 3